

### ABSTRACT

A new method for the electrolytic production of aluminum, using a new electrolyte composition and low temperature operation, is provided. The electrolyte comprises a mixture of aluminum fluoride-potassium fluoride with from about 2 wt. % to 6 wt. % of alumina. The new electrolyte allows for the electrolytical reduction of alumina at temperatures as low as 700<sup>0</sup>C. The lower temperature allows for the use of inert anodes, and is conducive to the use of wetted cathodes. The new electrolyte mixture has a higher solubility for alumina and remains entirely liquid, even with 5 wt. % of alumina present in the electrolyte during electrolysis. Oxygen (O<sub>2</sub>) is the only gas generated during alumina electrolysis with the new electrolyte and the inert anodes, thus eliminating the production of greenhouse gases. Anodes and cathodes can be mounted in either a vertical, horizontal, or some other configuration.